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CRITERIA FOR THE DIFFERENTIATION OF SCHISTOSOME LARVAE *

ERNEST CARROLL FAUST

Stimulated by the practical phases of the Schistosome problem, several investigators have recently made notable contributions to the morphology and life-history of the Schistosome group. Cort (1919) has cleared up the details of structure of the cercaria of *Schistosoma japonicum*, while Leiper (1915) and Iturbe (1919) have demonstrated life-histories. Intensive study of this group of cercariae has made possible the ready separation of the human schistosome larvae from those of the group which infect other animals and, at the same time, has allowed a differentiation among the human species.

Thus the cercariae of the human schistosome species lack certain details of structure found in the non-human schistosome larvae. As far as the present knowledge indicates the former have no fluted margin to the tail trunk or furcae. They lack eye-spots. They have no pharyngeal sphincter around the esophagus. Moreover, they possess a smaller number of flame cells than is found in any other cercaria where the flame-cell formula is known.

The human schistosome cercariae have in common an integument covered in its entirety with heavy spines, usually somewhat heavier at the anterior end than near the furcal tips. They have a large pyriform oral sucker directed anteriorly, but opening somewhat ventrad as Cort (1919) has shown. In the case of the cercariae of *Schistosoma haematobium* and *S. mansoni* the orifice is larger than in the cercariae of *S. japonicum* and is not conspicuously ventrad (see figures).

A conspicuous organ in the anterior region of the cercaria of the Japanese fluke is the head gland. I have found it to be decidedly basophilic in reaction, resembling the basophilic mucin glands of the larva of *S. mansoni*. Unlike this species, the other two species lack such an organ, by which means they may be readily separated from it. All three species have large conspicuous unicellular mucin glands with heavy ducts which open thru hollow boring spines anteriorly and laterally with respect to the mouth.

Cort (1919: 500) describes these glands in detail for the cercaria of *Schistosoma japonicum*. There are five of them on each side with ducts passing ventrad to the nervous system and hence thru the heavy muscular region of the mouth. More recently he has discovered in

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his material what I have made out for the three known human species as well as for several non-human forms, that each duct is capped by a hollow boring spine, so that digestion of the host tissues and boring into them are performed by the same organ (Faust, 1919). These glands in the cercaria of *S. japonicum*, according to both Cort's and my observations on living material, are large organs with granular acidophilic cytoplasm and large nuclei with basophilic reaction. Thus with hematoxylin-erythrosin technic the cytoplasm stains a decided pink, while the nuclei take on a deep alkaline stain.

While probable differences in size and shape obtain in the case of the cercariae of *Schistosoma haematobium* and *S. mansoni*, which allow of their differentiation from the cercaria of *S. japonicum*, the number and type of the mucin glands is the most dependable basis of diagnosis. Thus the larva of *S. haematobium* has only three pairs of glands with a corresponding number of ducts opening strictly laterad to the orifice. The glands have small nuclei and give a simple acidophilic reaction. On the other hand, the larva of *S. mansoni* has six pairs of glands, with an equal number of ducts which are arranged around the orifice dorsolaterally in the form of two compressed crescents. Moreover, this species has the glands differentiated into two types. Two of the glands are acidophilic with large nuclei, while four give a basophilic reaction and have small nuclei. The basophilic glands take on a deep reddish hue with Best's calcium-ammonium-carmin stain. That the content of the gland undergoes a change as it passes into the duct is apparent from the fact that the granules around the nuclei of these basophilic cells are glycogeniferous, while the content of the duct gives a pure mucin reaction.

This method of distinguishing between these species of larvae makes it possible to diagnose two species in material which Dr. F. G. Cawston has sent the writer from Natal, namely, cercariae of *Schistosoma haematobium* and those of *S. mansoni*. The latter species corresponds both by structural and microchemical tests to Iturbe's species for Venezuela. This discovery of the larva of Manson's fluke in Natal is not entirely unexpected after Porter's discovery (1918:45) of the adult fluke in South Africa. It shows further that the symptoms of rectal and urinary bilharziasis have not in themselves been sufficiently appreciated to discriminate between these parasites. Thus ability to recognize the larvae where a double infection obtains in a certain area adds a valuable check to the diagnosis and the combating of the disease.

A study of the immature larva of *S. mansoni* provided evidence of the fundamental difference between the two varieties of mucin glands in this species. At a stage before the furcae of the tail become

evident (Fig. 6) the two groups have already assumed their relative positions, have divided into the number characteristic of the adult and give the differential staining test.

It seems highly probable that the methods of specific diagnosis found valuable in separating these larval species may be used to equal advantage in other related groups.

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EXPLANATION OF PLATE XV

Fig. 1.—Ventral view of the cercaria of *Schistosoma haematobium*, showing oral opening, mucin glands and ducts, and germ cells.

Fig. 2.—Lateral view of head of the cercaria of *S. mansoni*, showing relation of mucin duct openings to mouth.

Fig. 3.—Lateral view of head of the cercaria of *S. haematobium*, showing relation of mucin duct openings to mouth.

Fig. 4.—Lateral view of head of the cercaria of *S. japonicum*, showing relation of mucin duct openings to mouth.

Fig. 5.—Ventral view of the cercaria of *S. mansoni*, showing oral opening, mucin glands and ducts, and germ cells.

Fig. 6.—Ventral view of immature cercaria of *S. mansoni*, showing development of mucin glands.

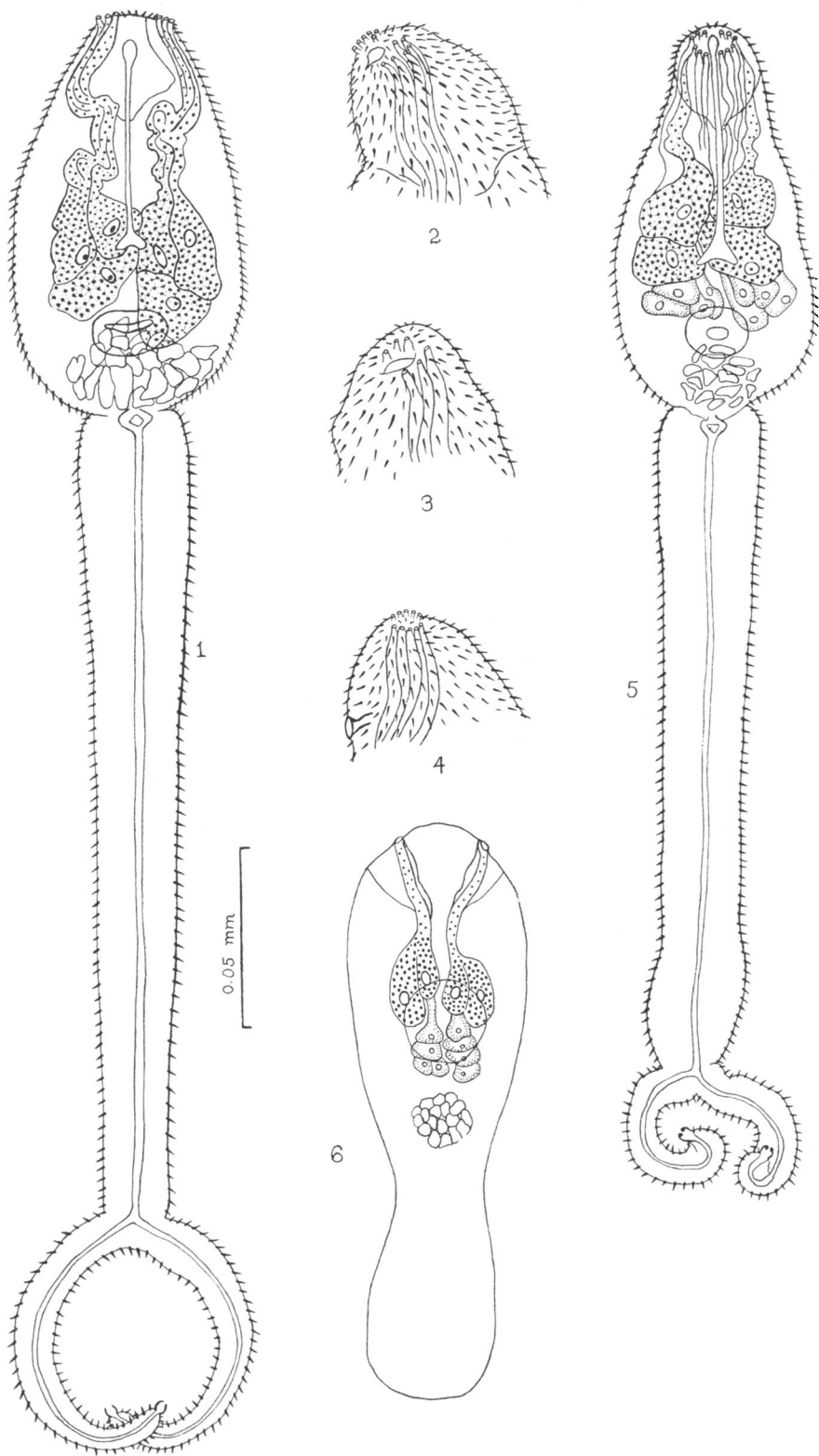


PLATE XV